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Description of two new species of *Polyonyx* Stimpson, 1858 from the Indo-West Pacific, with a key to the species of the *Polyonyx sinensis* group (Crustacea: Decapoda: Porcellanidae)

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Abstract.—Two new species of the genus *Polyonyx* Stimpson, 1858, *P. tulearis* and *P. thai* are described. The new species belong to the *P. sinensis* group, which currently contains 11 species from the Indo-West Pacific, three from the eastern Atlantic, and three from American waters. A key for all species in this group is included.

The *Polyonyx sinensis* species group was defined by Johnson (1958: 97) for taxa characterized by him as follows: "Lateral margins of carapace without spines. Carapace broader than long, transversely ovate, or rectangular with rounded corners. Front rather narrow, trilobate with the median lobe broad and rounded and projecting little beyond the lateral lobes, which are often scarcely developed so that the front is almost straight. Chelipeds with the anterior margins of the carpus and merus unarmed; a more or less marked development of hairs on their outer, and often also on their inner surfaces. Legs hairy dorsally, and often the carapace also more or less hairy. Dactyl of the walking legs with the dorsal claw much smaller than the ventral claw, and bearing two or three accessory spinules." Most of the species are definitely known to live as commensals of tube dwelling polychaetes. The species of the group are widespread in the Indo-West Pacific where it is represented now by 11 species. Three additional species are known from the tropical eastern Atlantic and three from American waters.

When Johnson (1958) revised the Indo-West Pacific species of the genus *Polyonyx,* the genus comprised 14 species, some of which were assigned to other genera by later workers (Ng & Sasekumar 1993). Of the Indo-West Pacific species attributed to the *P. sinensis* group by Johnson (1958), *P. sinensis* Stimpson, 1858, *P. utinomii* Miyake, 1943, *P. pedalis* Nobili, 1905, and *P. transversus* (Haswell, 1882), are currently considered as valid. In addition, *P. loimicola* Sankolli, 1965, *P. maccullochi* Haig, 1965, *P. haigae* McNeil, 1968, *P. vermicola* Ng & Sasekumar, 1993, and *P. bella* Hsueh & Huang, 1998, have been described since then and adescribed to the *P. sinensis* group by the original authors. *P. bella* is considered a junior synonym of *P. sinensis* (see Discussion). The position of *P. plumatus* Yang & Xu, 1994 was not discussed at all in the original description, it seems to be identical with *P. haigae* and is considered a junior synonym of that species. *P. cometes* Walker, 1887 which was included in the *P. sinensis* group by Johnson (1958) was placed in a new genus by Ng & Nakasone (1993) but is considered a member of the *P. sinensis* group in this paper since it fits in all respects with Johnson's definition. The three *Polyonyx* species from western Africa (Chace 1959) correspond with the basic morphological features of the *P. sinensis* group and have to be included here. The same is true for three species from the Americas which were recognized by Haig (1960) as clearly belonging to Johnson's *P. sinensis* group. The type species of the genus, *P. gibbesi,* is the only

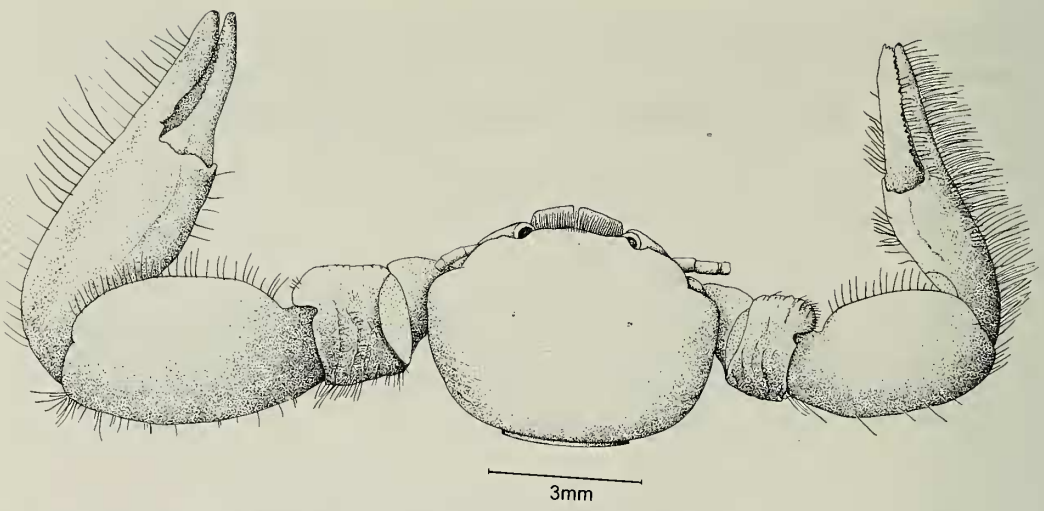

Fig. 1. *Polyonyx tulearis,* new species. Male holotype, Tulear, Madagascar, USNM 296465: dorsal view of body and chelipeds.

species from the western Atlantic and a common commensal in the tubes of the annelid *Chaetopterus variopedatus* (Renier).

Study of collections in the National Museum of Natural History, Smithsonian Institution, Washington D.C. (USNM), revealed the presence of two undescribed species of the *P. sinensis* group from the Indo West Pacific. The measurements given refer to maximum carapace length (CL) and carapace width (CW).

Family Porcellanidae

Polyonyx tulearis, new species
Figs. 1, 2

Material.—Holotype: male, CL 4.1 mm, CW 5.2 mm, Madagascar, Tulear, shore, RV *Anton Bruun,* hand-collected, 11 Aug 1964, USNM 296465. Paratype: ovigerous female, CL 5.4 mm, CW 7.3 mm, same data as holotype, USNM 296466.

Description.—Carapace (Fig. 1) subovate, about 1.3 times as wide as long, broadest at epibranchial level; moderately convex longitudinally. Cervical and gastric grooves distinct, epigastric elevations prominent; anterolateral margin depressed at beginning of cervical groove to receive basal part of antennae; surface smooth anteriorly, slightly rugose with oblique striae near postero-lateral margins; devoid of setae except with scattered plumose setae near lateral margins and with forward-directed setae fringing frontal margin. Front broad, slightly trilobed in dorsal view, distinctly trilobate in frontal view (Fig. 2A), median lobe bluntly rounded, extending somewhat beyond lateral lobes. Orbits well defined; eyes large, partly visible from above.

Basal antennal segment with transverse crest; ventral face partly bent upward, visible from above. Segments of peduncle smooth.

Third thoracic sternite slender, without median lobe. Ischium of third maxilliped (Fig. 2D) about as long as broad, with scattered long setae on outer face.

Merus of chelipeds (Fig. 1) with well developed, anteriorly crenulate rounded lobe, laterally setose, with transverse, setose rugae on upper surface; outer distal angle of smaller cheliped with several conical tubercles. Carpus about 1.6 times as long as wide, surface smooth except for some low transverse striae near outer border; inner shelf evenly convex throughout length, finely denticulate on proximal half of mar-

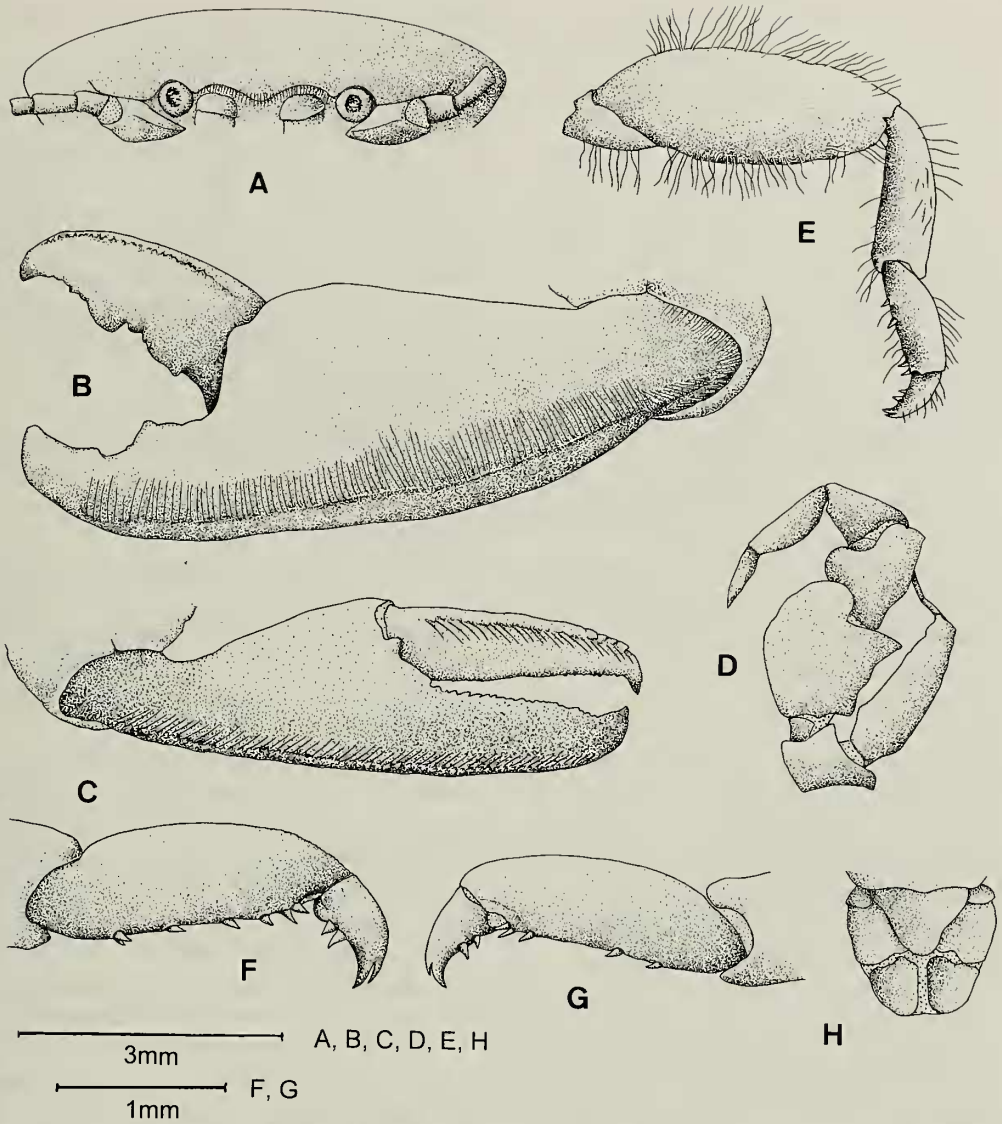

Fig. 2. *Polyonyx tulearis,* new species. Male holotype, Tulear, Madagascar, USNM 296465: A. front, anterior view; B. left (greater) chela, dorsal view; C. right (smaller) chela, ventral view; D. third left maxilliped, outer view; E. first left ambulatory leg, ventral view; F. propodus and dactylus of second right ambulatory leg, dorsal view; G. first left ambulatory leg, propodus and dactylus, dorsal view; H. telson, dorsal view.

gin, fringed with widely-set plumose setae. Chelae (Figs. 1, 2B, C) swollen, smooth, except for faint longitudinal ridge starting from dorsal articulation of movable finger; external margin with tuberculate ridge visible only in lateral view, fringed with row of simple setae. Fingers slightly curved outward. Fingers of mayor cheliped somewhat gaping near tip, movable finger with denticulate ridge throughout length starting from outer articulation. Cutting edge of pollex with strong tubercle-like tooth proximally and smaller tooth distally; dactylus with 2 large tooth, first near base and second median; fingers of smaller cheliped closing completely, movable finger with ac-

centuated longitudinal ridge formed by row of tubercle-like teeth accompanied by dense fringe of setae; cutting edge of both fingers denticulate.

Ambulatory legs (Figs. 2E–G) decreasing in size from first to third pair, moderately setose. Merus and carpus unarmed; propodus about 3 times as long as wide, armed on lower margin with 5–7 stout, movable spinules including pair at distal end, proximal spines sometimes paired. Dactylus hooked, with bifid tip and 2 strong conical spinules on lower margin, distal one usually largest.

Uropods and telson (Fig. 2H) fringed with long plumose setae; males with pair of pleopods.

Habitat.—The only known specimens were collected by hand from the shore, but no commensalism was reported.

Etymology.—The specific name is derived from the type locality, Tulear, Madagascar.

Remarks.—*Polyonyx tulearis* is most similar to congeners that have a prominent crested lobe on the merus of the chelipeds, more than three terminal spines on the propodus of the walking legs, and lack spinulation on the inner side of all walking legs. *Polyonyx quadratus* is distinct because of the tubercles on the outer side of the chelae. The remaining species, *P. maccullochi, P. senegalensis, P. vermicola,* and the second new species described here, *P. thai,* have the fingers of the larger cheliped strongly curved outward, a character that easily distinguishes them from *P. tulearis.*

Polyonyx thai, new species
Figs. 3, 4

Material.—Holotype: male, CL 2.7 mm, CW 4.0 mm, Thailand; Chorburi Province, Bang Saen Beach, Gulf of Thailand, 13°20′N 100°55′E, 15 Jan 1959; exposed sand beach, commensal with polychaete worms (Chaetopteridae), leg. Dr. G. M. Moore, USNM 296463. Paratype: ovigerous female, CL 3.4 mm, CW 4, 9 mm, same data as holotype, USNM 296464.

Description.—Carapace (Fig. 3) subrectangular, 1.4–1.5 times wider than long, broadest at epibranchial level; moderately convex from front to back; anterolateral margin somewhat depressed to receive basal portions of antennae; carapace regions faintly indicated, surface punctate, without setae except on posterolateral margins and lateral walls. Front broad, sinuously trilobate in dorsal and frontal view (Fig. 4A), lobes obtuse, median lobe scarcely extending beyond lateral lobes; frontal margin with row of upwardly directed short setae. Orbits shallow; eyes large, completely visible from above.

Basal segments of antennae triangular, with transverse crest, partly visible from above; segments of peduncle cylindrical, smooth, flagellum large, reaching nearly twice length of carapace, with short stiff setae throughout length.

Third thoracic sternite narrow, trilobate anteriorly; median lobe broadly triangular, lateral lobes with rounded tip. Ischium of third maxilliped (Fig. 4C) about as long as broad with scattered long setae on outer face.

Chelipeds (Fig. 3) unequal, merus with well developed cristate lobe extending distally beyond proximal border of merus, upper surface with some rugae, lateral borders fringed with plumose setae. Carpus about 1.5 times longer than wide, upper surface evenly rounded, smooth; inner border tapering proximally, broadening to large rounded lobe fringed with line of large plumose setae; external portion of carpus with scattered setae. Larger chela (Fig. 4F) swollen, surface smooth, thickly setose near external margin; similar setation on internal margin extending into gape of fingers. Fingers curved outward, gaping, dactylus considerably shorter than pollex; cutting edge of pollex with large conical tooth proximally, dactylus with large rounded tooth near base and a smaller tuberculate one submedially. Chela of smaller cheliped (Figs.

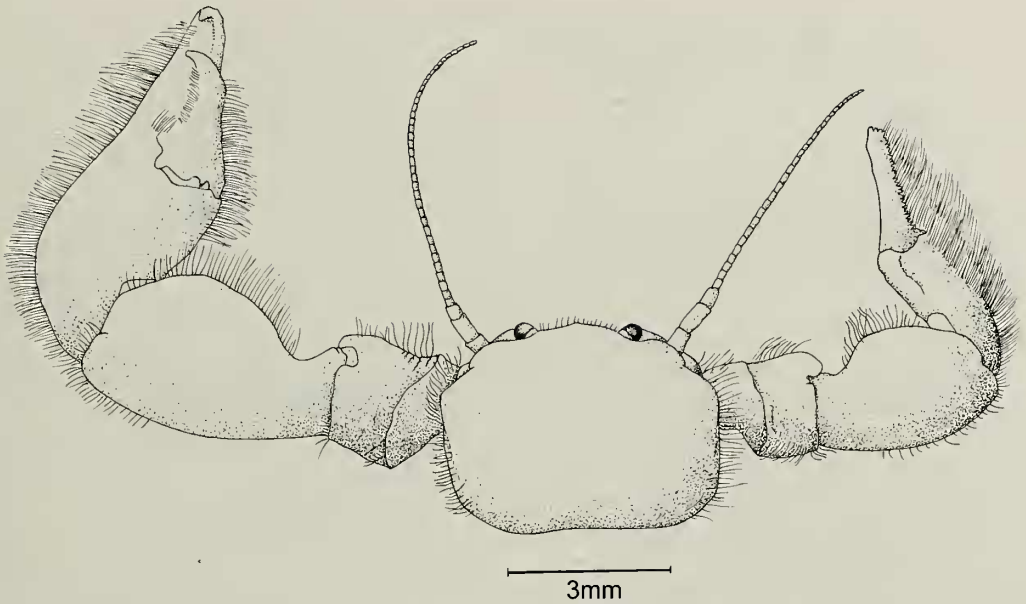

Fig. 3. *Polyonyx thai,* new species. Male holotype, Bang Saen Beach, Chorburi Province, Gulf of Thailand, USNM 296463: dorsal view of body and chelipeds.

4D, E) slender, fingers slightly curved outward; palm with faint ridge starting from articulation of movable finger; outer border of palm and fingers covered with long, plumose setae, movable finger with long elevated ridge along outer margin formed by row of flattened rounded tubercles; fingers closing completely, cutting edges with fine denticulation.

Ambulatory legs (Figs. 4G–I, K) decreasing in size from first to third pair, thickly setose. Merus and carpus unarmed; propodus 2 times as long as wide, armed on lower margin with three to five conical spines in addition to three terminal spines. Dactylus compact, on lower margin with bifid curved tip and two strong conical spinules, distal one largest.

Uropods and telson fringed with long plumose setae; first pair of pleopods present in males.

Variations.—The setation of the frontal margin of the female paratype is denser and not confined in a row as in the male holotype. In contrast to the smooth surface of the larger chela of the male, that of the female paratype bears a faint dorsal ridge which joins the dorsal articulation of the dactylus and which continues, more pronounced, on the dorsal margin of the dactylus, and becomes tuberculate towards the tip of the finger. The three left walking legs of the paratype female also have more spines on the lower margin of the propodus than the holotype, numbering eight, five and seven respectively in addition to the three terminal spines, from first to third leg, versus five, three and four respectively for the male holotype.

Habitat.—The new species was collected from chaetopterid worm tubes together with a series of *P. sinensis* (three males and two females).

Etymology.—The species name is derived from the country of the type locality, Thailand, used as a noun in apposition.

Remarks.—*Polyonyx thai* has the fingers of the larger cheliped strongly curved outward, a character shared only with three other species of the group. From *P. vermicola,* it is most easily distinguished by the form of the carpus of the larger cheliped,

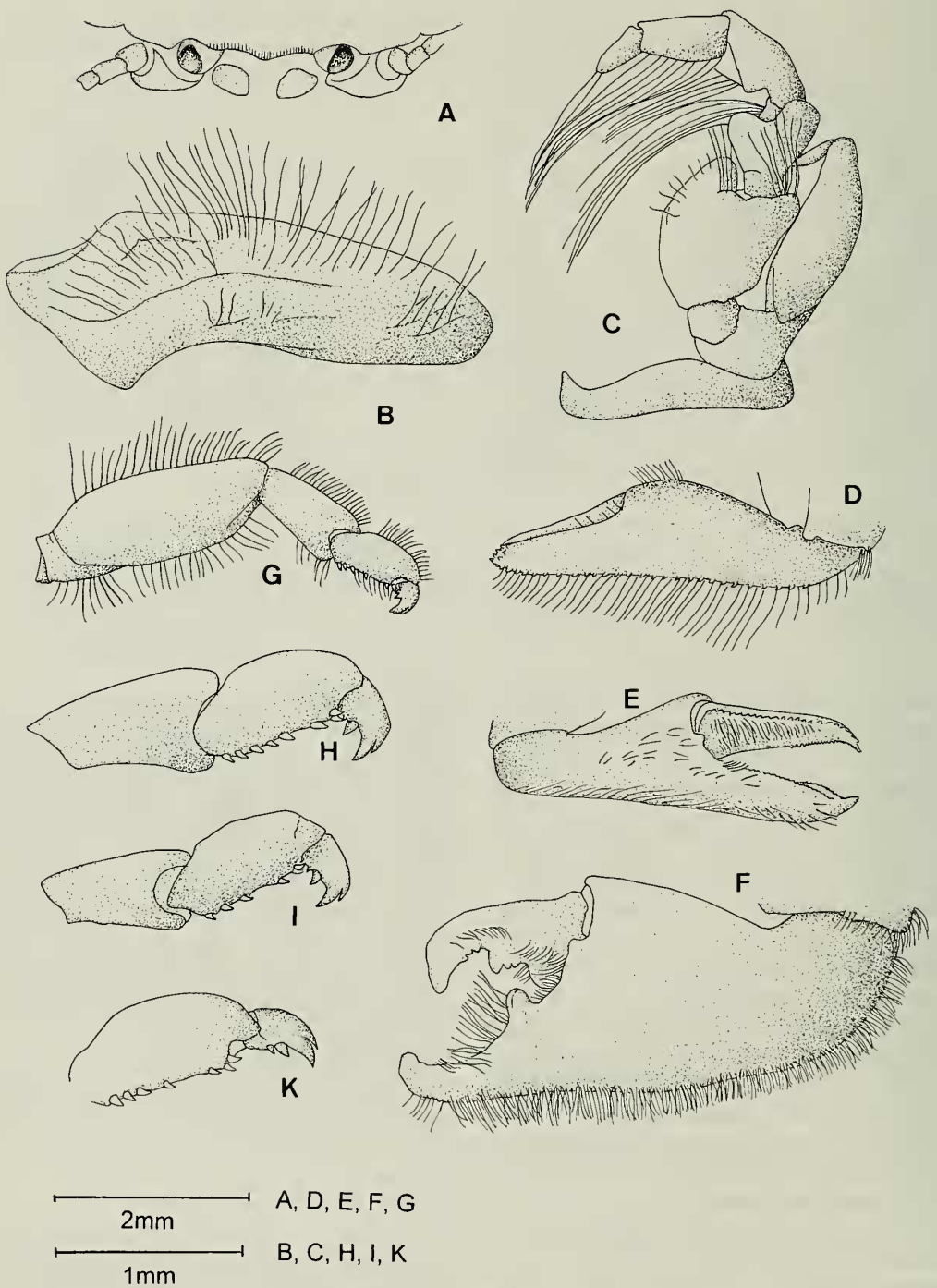

Fig. 4. *Polyonyx thai*, new species. Male holotype Bang Saen Beach, Chorburi Province, Gulf of Thailand: A. front, anterior view; B. left lateral wall of carapace; C. third left maxilliped, outer view; D. right (smaller) chela, ventral view; E. same, dorsal view; F. left (greater) chela, dorsal view; G. first right ambulatory leg; H. same, detail of propodus and dactylus; I. second right ambulatory leg, detail of spinulation of propodus and dactylus; K. third right ambulatory leg, detail of spinulation of propodus and dactylus.

the inner margin being concave over the proximal half in that species, whereas *P. thai* has only a short concavity on the much shorter carpus of both chelipeds. The cutting edge of the pollex of the larger chela is entire in *P. vermicola,* whereas there is a very prominent rounded tooth in *P. thai. Polyonyx senegalensis* can be distinguished by the convex frontal carpal lobe of the chelipeds, and the absence of prominent teeth on the cutting edges of the larger chela. *Polyonyx maccullochi* differs in the subovate carapace which is only slightly broader than long, the narrow front with a strong median lobe and the lack of a concavity on the proximal inner margin of the carpus of the chelipeds. The new species and the specimens of *P. sinensis* included in the same sample represent the first finding of members of the *P. sinensis* group in Thailand and increase the number of species reported for Thailand by Yang & Naiyanetr (1997) to 17.

Discussion

When Johnson (1958) divided the genus *Polyonyx* he characterized the *P. biunguiculatus* group as ". . . the central and largest group of the genus" and assigned *P. biunguiculatus* (Dana, 1852), *P. obesulus* Miers, 1884, *P. parvidens* Nobili, 1905, *P. triunguiculatus* Zehntner, 1894 and, with some doubts, *P. hendersoni* Southwell, 1909 to that group. Later, Haig (1979) included *P. parvidens* in the synonymy of *P. obesulus.* Actually, the differences discussed by Johnson (1958), and some other morphological features which can be seen in the description of *P. hendersoni* by Tirmizi et al. (1989), and additional ones which were revealed in a recent study of Hendersons material from the London Museum set this species apart from typical *Polyonyx. Polyonyx hendersoni* does not fit at all with any group of *Polyonyx* and will be assigned to a separate genus in a forthcoming paper, together with *P. splendidus* Sankolli, 1963 which was placed in the *P. biunguiculatus* group by Sankolli (1965).

As a result, the *P. biunguiculatus* group now comprises just three species that are restricted to the Indo-West Pacific. All of those three species are free living, and while they are sometimes associated with corals and sponges, they are never found in worm tubes, as are most of the remaining *Polyonyx* species.

By far the largest *Polyonyx* species group is the *P. sinensis* group. Johnson (1958) considered only the species from the Indo-West Pacific, and subsequent workers (e.g., Sankolli 1965, Ng & Sasekumar 1993, Hsueh & Huang 1998) never compared all species in a worldwide context. For the eastern Pacific, Haig (1960) recognized *P. nitidus* Lockington, 1878 and *P. quadriungulatus* Glassell, 1935. Haig (1960) considered the warm temperate outer Baja California population of *P. quadriungulatus* different from the Gulf of California *P. nitidus.* The range of *P. nitidus* was later extended southward to Panama (Haig 1962) and Isla Gorgona, Colombia (Werding & Haig 1982). The discovery of *P. quadriungulatus* by Kudenow & Haig (1974) in the Gulf of California led those authors to admit that both taxa might be conspecific. Comparison of the basic characters used by Haig (1960) to separate the two species (spinulation of the propodi and dactyli of the walking legs) indicate that these characters are not constant. Therefore, *P. quadriungulatus* is considered a junior synonym of *P. nitidus.* Additionally, a second species *P. confinis* Haig, 1960 is present in the eastern Pacific. This species has been found only once, and an association with a host species was not observed. The description of *P. bella* by Hsueh & Huang (1998) and a pair of paratypes from the USNM was compared with a series of *P. sinensis* from Thailand, found together with the type series of *P. thai,* new species, in the USNM. *Polyonyx bella* is not distinguishable from *P. sinensis,* and is therefore considered a junior synonym of that species.

Polyonyx cometes is here considered a member of the *P. sinensis* group since the characters revealed by Ng & Nakasone (1993) for the genus *Eulenaios* Ng & Nakasone, 1993, do not withstand a critical review on a worldwide level. The authors consider the setal pattern as perhaps the "most distinctive feature of the species". However, the setation is a character which exhibits a wide variation in the different species, and seems to be inadequate for the establishment of a separate genus. The same is true for the shape of the carapace and the form of the front and the carapace regions. The ridge of granules observed on the dactylus of the smaller cheliped is used by Ng & Nakasone (1993) as an additional character defining *Eulenaios.* But similar ridges are present in *P. senegalensis* and in both new species described herein. Further, the authors mention the membranous articulation between cheliped carpus, merus and propodus as "seeming more extensive than in other species". This obviously quantitative feature appears in a very similar degree in *P. gibbesi* where it was checked for comparison. Another argument is the size of the species which is described as "larger than any other known *Polyonyx* species". But the largest *P. cometes* dealt with is 11.2 × 8.2 mm. The holotype of *P. quadriungulatus* (= *P. nitidus*) measures 13.5 × 9.1 mm and that of *P. nitidus* 10 × 7 mm (Haig 1960), and Williams (1984) indicates for *P. gibbesi* a maximum breadth of 16 mm. For the australian *P. transversus,* Baker (1905) and Haig (1965) record a size of 11 × 8 mm. As a distinguishing larval property Ng & Nakasone (1993) mention the form of the telson of zoea I "being more proportionally elongate than in any other known species". Probably, the authors were not aware of the larval descriptions given by Shenoy & Sankolli (1973) for *P. loimicola* and those from Shepherd (1979) for *P. transversus.* As all other known *Polyonyx* larvae, the two species exhibit an elongate telson in Zoea I. Shepherd records a broads : length ration of 1 : 1.75 for the larvae of *P. transversus* and the respective value given by Ng & Nakasone for *P. cometes* is "about 1 : 1.8". Finally, the insertion of the telson setae of the first zoea as appears in Fig. 5, I in the paper of Ng & Nakasone (1993) shows apparently an incompletely developed telson as it is typically present in prezoeae. On the other hand, the *P. sinensis* group including *P. cometes* exhibit some key characters which make advisable to maintain the group as a systematic category. The common features are in the unique form of the chelipeds and the dactyls of the walking legs. An even more significant feature may be seen in the adaptation of living in tubes of annelid worms which is developed only in the members of the *P. sinensis* group.

Key to species of the *Polyonyx sinensis* group

1. Walking legs with merus unarmed ventrally 2
– At least third pair of walking legs armed with spines ventrally on merus 14
2. Frontal and lateral parts of carapace and chelipeds densely coated with setae which obscure the outline of the structure (Singapore) .... *Polyonyx cometes* Walker, 1887
– Setation of carapace and chelipeds different 3
3. Propodus of walking legs without spines except for terminal triplet 4
– Propodus of walking legs with at least one spine in addition to terminal triplet 6
4. Frontal lobe acute in frontal view, extending well beyond obtuse lateral angles (western Africa) .... *P. bouvieri* Saint-Joseph, 1900
– Frontal lobe scarcely produced, not extending beyond lateral angles 5
5. Carapace margins with thickly matted setae; meral lobe of chelipeds slightly produced (western coast of India) .... *P. loimicola* Sankolli, 1965
– Carapace margins not setose; meral lobe of chelipeds largely produced (Japan) ..... *P. utinomii* Miyake, 1943
6. Outer surface of chelae with scattered

tubercles (western Africa) .... *P. quadratus* Chace, 1959
– Outer surface of chelae without tubercles 7
7. Dorsal surface of carapace with scattered long setae; Propodus of walking legs with numerous (>60) minute spinules at lower margin (western Pacific) ..... *P. haigae* McNeil, 1968 (Syn. *P. plumatus* Yang & Xu. 1994)
– Dorsal surface of carapace not setose; propodus of walking legs without numerous minute spinules (<20) at lower margin 8
8. Inner margin of carpus of both chelipeds evenly convex 9
– Inner margin of at least mayor cheliped convcave proximally, convex distally 12
9. Propodus of walking legs with more than 12 spinules on lower margin (Australia) .... *P. transversus* (Haswell, 1882)
– Propodus of walking legs with less than 10 spinules on lower margin 10
10. Chelipeds slender, fingers of both chelae straight (Madagascar) .... *P. tulearis,* new species
– Chelipeds stout, fingers of larger chela bent outward distally 11
11. Front narrow, forming a prominent acute median lobe; proximal inner angle of carpus of chelipeds softly rounded (Australia) *P. maccullochi* Haig, 1965
– Front broadly obtuse, median lobe blunt; proximal inner angle of carpus of chelipeds forming a rounded nearly rectangular angle (western Africa) ... . *P. senegalensis* Chace, 1959
12. Inner border of carpus of chelipeds tapering proximally forming a deep short concavity; carpus of larger cheliped about 1.5 times broader than long (Gulf of Thailand) ..... *P. thai* new species
– Inner border of carpus of larger cheliped concave over the proximal half; carpus of larger cheliped about 2 times broader than long 13
13. Pollex of larger cheliped with large blunt subproximal tooth on cutting edge (western Pacific) .... *P. sinensis* Stimpson, 1858 (Syn. *P. bella* Hsue & Huang, 1998)
– Pollex of larger cheliped entire on cutting edge (peninsular Malaysia) ... . *P. vermicola* Ng & Sasekumar, 1993
14. Proximal angle of carpal lobe of chelipeds obtuse (Indian Ocean) .... *P. pedalis* Nobili, 1905
– Proximal angle of carpal lobe of chelipeds strongly pronounced, subrectangular (American species) 15
15. Longitudinal crest on the manus of the mayor cheliped (eastern Pacific—Nicaragua) ..... *P. confinis* Haig, 1960
– Manus of chelipeds without longitudinal crest 16
16. Propodus of walking legs without movable spinules additional to the posterodistal triplet, manus of minor cheliped markedly outcurved (western Atlantic) ..... *P. gibbesi* Haig, 1956
– Propodus of walking legs with one or two movable spinules additional to the posterodistal triplet, manus of minor cheliped not markedly outcurved (eastern Pacific) .. *P. nitidus* Lockington, 1878

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Literature Cited

Baker, H. W. 1905. Notes on South Australian decapod Crustaceans. Part III.—Transactions of the Royal Society of South Australia 29:252–269.

Chace, F. A. 1959. Porcellanid crabs.—Expédition Océanographique Belge dans les Eaux Côtières Africaines de l'Atlantique Sud (1948–1949), Resultats Scientifiques III (5):1–45.

Dana, J. D. 1852. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes.—U.S.N. 13, Crustacea, part 1, (viii), Philadelphia, 685p.

Glassell, S. A. 1935. New or little known crabs from the Pacific coast of northern Mexico.—Transactions of the San Diego Society of Natural History 8:91–106.

Haig, J. 1956. The Galatheidea (Crustacea Anomura) of the Allan Hancock Atlantic Expedition with a reviev of the Porcellanidae of the western north Atlantic.—Allen Hancock Atlantic Expedition 8:1–44.

———. 1960. The Porcellanidae (Crustacea Anomura) of the eastern Pacific.—Allan Hancock Pacific Expeditions 24:1–440.

———. 1962. Papers from Dr. Th. Mortensen's Pacific expedition 1914–1916. 79. Porcellanid crabs from eastern and western America.—Videnskabelige Meddeleser fra Dansk Naturhistorisk Forening i København 124:171–192.

———. 1965. The Porcellanidae (Crustacea, Anomura) of Western Australia, with descriptions of four new Australian species.—Journal of The Royal Society of Western Australia 48(4):97–118.

———. 1979. Expédition Rumphius II (1975) Crustacés parasites, commensaux, etc. (Th. Monod et R. Serène, éd.) V. Porcellanidae (Crustacea, Decapoda, Anomura).—Bulletin du Museum national de Histoire naturel, Paris, 4e sér., 1, 1979, section 1, 1:119–136.

Haswell, W. A. 1882. Catalogue of the Australian Stalk- and Sessile-eyed Crustacea.—Australian Museum Sidney.

Hsueh, P.-W., & J.-F. Huang. 1998. *Polyonyx bella,* new species (Decapoda: Anomura: Porcellanidae), from Taiwan, with notes on its reproduction and swimming behaviour.—Journal of Crustacean Biology 18:332–336.

Johnson, D. S. 1958. The Indo-West Pacific species of the genus *Polyonyx* (Crustacea, Decapoda, Porcellanidae).—The Annals of Zoology II (8):95–118.

Kudenow, J. D., & J. Haig 1974. A range extension of Polyonyx quadriungulatus Glassell, 1935, into the Gulf of California (Decapoda Anomura, Porcellanidae).—Crustaceana 26(1):105–106.

Lockington, W. N. 1878. Remarks upon the Porcellanidae of the west coast of North America.—Annals and Magazine of Natural History 5(2):394–406.

McNeil, F. A. M. 1968. Crustacea Decapoda.—Great Barriere Reef Expedition 1928–29, Scientific Reports VII (1), British Museum of Natural History: Family Porcellanidae: 34–39.

Miers, E. J. 1884. Crustacea.—Records of the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. 'Alert' 1881–2, London.

Miyake, S. 1943. Studies on the crab-shaped Anomura of Nippon and adjacent waters.—Journal of the Department of Agriculture, Kyushu Imperial University 7(3):49–158.

Ng, P. K. L., & Y. Nakasone 1993. Taxonomy and ecology of the porcellanid crab *Polyonyx cometes* Walker, 1887 (Crustacea; Decapoda), with a description of a new genus.—Journal of Natural History 27:1103–1117.

———, & A. Sasekumar 1993. A new species of *Polyonyx* Stimpson, 1858, of the *P. sinensis* group (Crustacea: Anomura: Porcellanidae) commensal with a chaetopterid worm from Peninsular Malaysia.—Zoologische Mededelingen 67:466–472.

Nobili, G. 1905. Diagnoses préliminaires de 34 espèces et varietés nouvelles et de 2 genres nouveaux de Décapodes de la Mer Rouge.—Bulletin du Museum d'Histoire Naturelle, Paris 11(2):393–411.

Saint-Joseph, Baron de. 1900. Sur quelques invertébrés marins des côtes du Sénégal.—Annales de Sciences naturelles, Zoologie, sér. 8, 12(2–3):217–248.

Sankolli, K. N. 1963. On a new species of porcellanid crab (Decapoda, Anomura) from India.—Journal of the Zoological Society of India 15(1):79–84.

———. 1965. On a new species of commensal porcellanid crab, *Polyonyx loimicola* sp. nov., from India: (Crustacea, Anomura, Porcellanidae).—Journal of the Bombay Natural History Society 62:285–291.

Shenoy, S., & K. N. Sankolli. 1973. Metamorphosis of two species of genus *Polyonyx* Stimpson—*P. hendersoni* Southwell and *P. loimicola* Sankolli (Anomura, Porcellanidae).—Journal of the Marine Biological Association of India 15(2):710–727.

Shepherd, M. C. 1979. The larval morphology of *Polyonyx transversus* (Haswell), *Pisidia dispar* (Stimpson) and *Pisidia streptochiroides* (De Man) (Deacpoda: Porcellanidae).—Proceedings of the Royal Society of Queensland 80(8):97–124.

Southwell, T. 1909. Report on the anomura collected by Mr. James Hornell at Okhamandal in Kattiawar in 1905–6. *In* J. Hornell, Report to the Government of Baroda on the marine zoology of Okhamandal in Kattiawar 1:105–123, London.

Stimpson, W. 1858. Prodromus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Pars VII. Crustacea Anomura.—Proceedings of the Academy of Natural Sciences of Philadelphia 1858:225–252.

Tirmizi, N. M., M. Yaqoob, & F. A. Siddiqui. 1989. Marine fauna of Pakistan: 3 Porcellanid crabs

(Crustacea, Anomura). Centre of Excellence in Marine Biology, University of Karachi, 75270 Pakistan, Publication 6:1–46.

Walker, A. O. 1887. Notes on a collection of crustacea from Singapore.—Journal of the Linnean Society of London, Zoology 20:107–117.

Werding, B., & J. Haig 1982. The porcellanid crabs from Isla Gorgona, Pacific coast of Colombia, with a description of Clastotoechus gorgonensis sp. nov. (Crustacea: Anomura).—Anales del Instituto de Investigaciones Marinasde Punta de Betín 12:57–70.

Yang, S. L., & P. Naiyanetr 1997. Thailand's porcellanid crabs (Crustacea: Decapoda: Anomura).—Memoirs of Beijing Natural History Museum 56:1–13.

———, & Z. X. Xu. 1994. Research on the geography, flora and fauna of the Nansha Islands and adjacent waters.—Beijing 1:112–124.

Zehntner, L. 1894. Voyage de MM. M. Bedot and C. Pictet dans l'Archipel Malais. Crustacés de l'Archipel Malais.—Revue Suisse de Zoologie 2:135–214.